WEATHER MONITORING HANDBOOK

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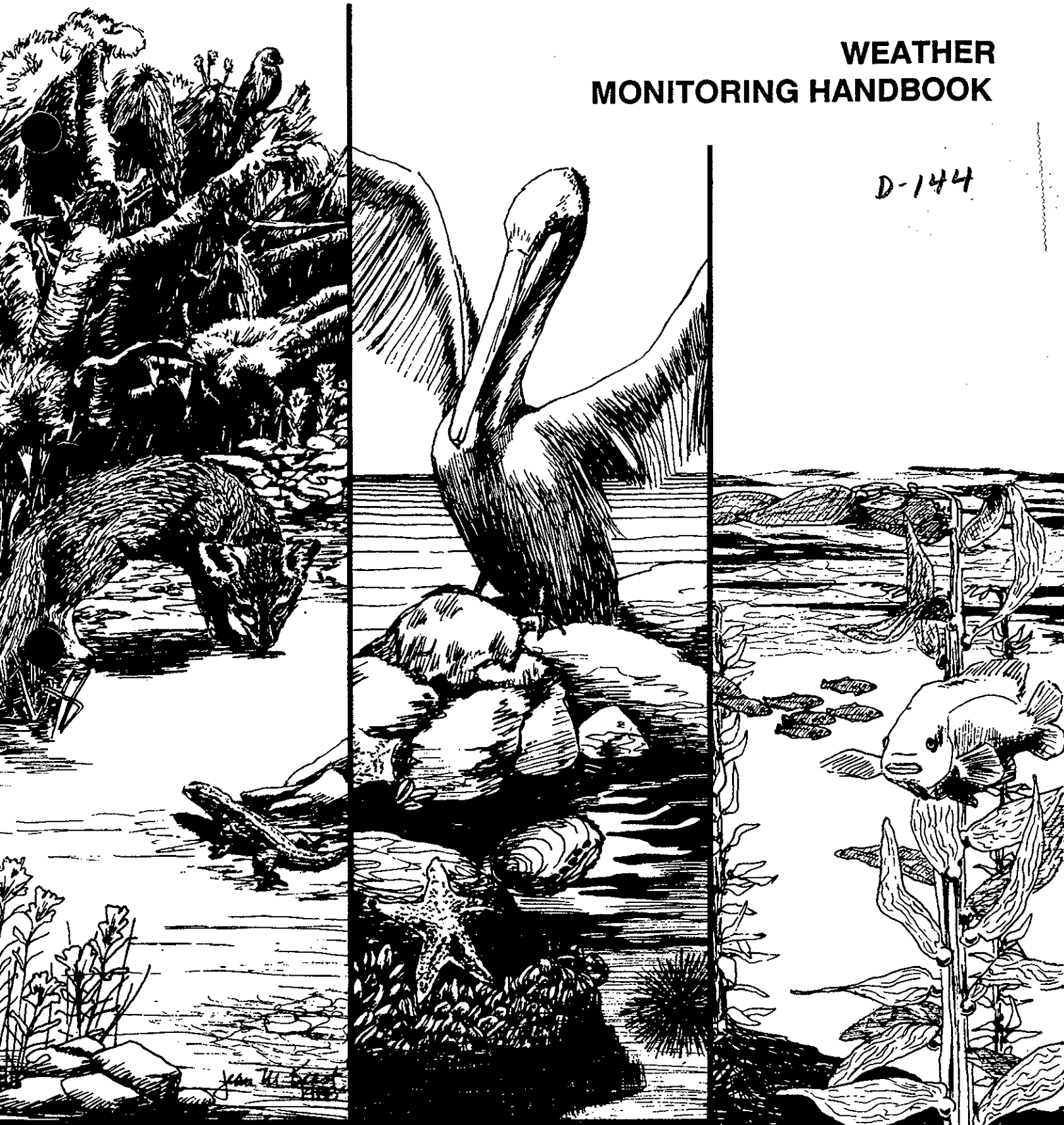

Channel Islands National Park

National Park Service
U.S. Department of the Interior

WEATHER MONITORING HANDBOOK

CHANNEL ISLANDS NATIONAL PARK CALIFORNIA

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Lucy Doyle

National Park Service
Channel Islands National Park
1901 Spinnaker Drive
Ventura, CA 93001

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ACKNOWLEDGEMENT

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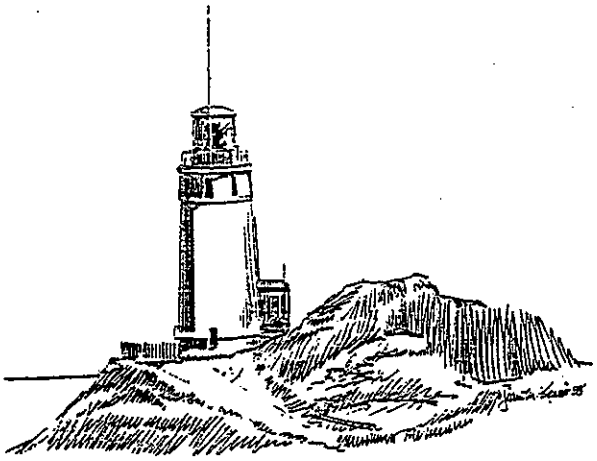
We are grateful for the guidance of Dolores Taylor, Sr. Engineer and County Hydrologist, Ventura County Flood Control and Water Resources Department for her assistance when we were first initiating this system of weather stations and for the assistance of her department in resolving problems we have since encountered.



INTRODUCTION

Weather exerts a strong influence on mortality rates, growing conditions, and long term population trends. Therefore, continual weather monitoring is a key factor in the study of population dynamics and an important aspect of the long-term monitoring program at Channel Islands National Park. Up-to-the-minute weather information is also important to the logistical support of park operations, transportation to the islands by aircraft or vessel, and visitor safety. Such information can be vital in the case of visitor use in an area of sometimes rapid and violent weather change. Established data of prior weather occurrences is also needed in any attempts to predict conditions influencing spread of oil spills, air pollution, or other unforeseen environmental hazards.

MONITORING DESIGN CONSIDERATIONS

A system of automated weather stations has been established on Anacapa, Santa Barbara, Santa Cruz, San Miguel, and Santa Rosa islands. The individual site locations were chosen to represent weather conditions at the highest, most unobstructed portion of each island. Weather parameters measured are wind speed and direction, rainfall, relative humidity, temperature, barometric pressure, and soil moisture. All weather data are transmitted to a computer receiving station at park headquarters via a Ventura County repeater on Sisar Peak. Data are accessible by trained users at the receiving station and via telecommunications. The Ventura County Flood Control District and the National Weather Service, Los Angeles, also have receiving stations which directly receive the stored data transmitted by the Channel Islands National Park weather stations. Similarly, park headquarters has the ability to receive data from any of the Ventura County weather stations by initializing their numbers on the computer.

MONITORING PROTOCOL

All weather stations currently in use in Channel Islands National Park are Sierra-Misco, Inc., Model 5081 Real Time Event Reporting Weather Stations coupled with International Hydrographic Services Enhanced Alert Software. These stations are totally self-contained, packaged weather stations used to automatically report weather data from remote sites to a central location. The main housing acts as a support for the solar panel, sensors, and antenna tower and also functions as a weather proof housing for the transmitter.

This Handbook Contains:

- Diagram and specifications for a typical automated recording/reporting weather station (see Figure 1 and Table 1).
- Weather station location descriptions including computer identification numbers.
- General monthly and biannual maintenance requirements and maintenance log.
- Maintenance log (see Appendix A).
- Data access information.
- Technical descriptions of sensors along with individual maintenance requirements and troubleshooting techniques supplied directly from manufacturer (see Appendix B).

Available from park headquarter files is extensive Sierra-Misco, Inc. schematics, wiring diagrams, and installation documentation.

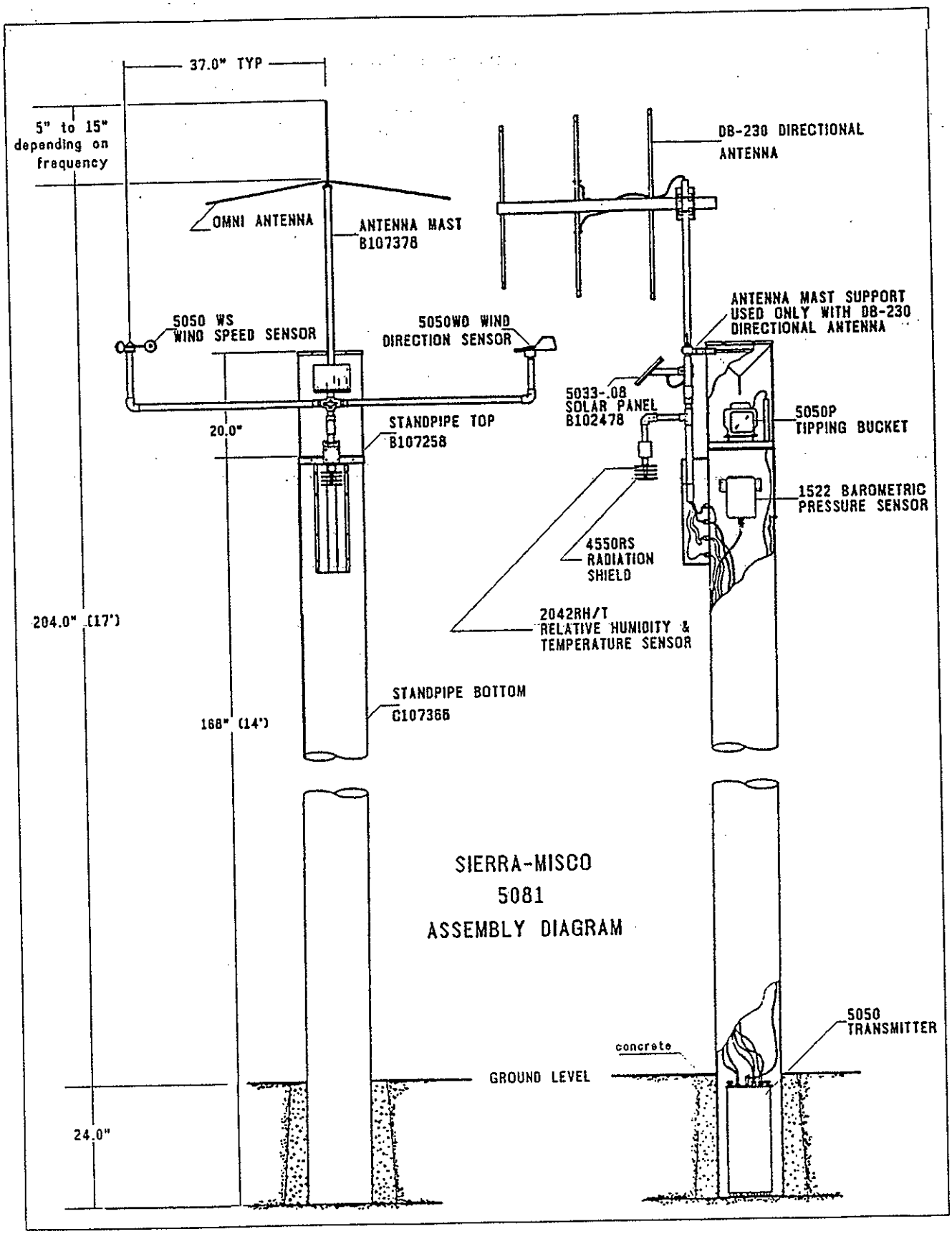


Figure 1. Diagram of Sierra-Misco, Inc., Model 5081 Real Time Event Reporting Weather Station.

Table 1. Sierra-Misco, Inc., Model 5081 Real Time Event Reporting Weather Station.

SPECIFICATIONS

SIERRA-MISCO, INC.
Model 5081 Real Time Event Reporting Weather Station

Antenna:	Model 5050ANT	Omni Antenna Height From Ground: 18 feet
Barometric Pressure:	Model 1520	Sensor
Humidity/Temperature:	Model 2042 Model 4550	Sensor Radiation Shield
Power Supply:	Model 5031-12 Model 5033-0.4	Gel Cell Battery Solar Panel with Regulator Circuit which produces 400 mA and allows for continuous operation of the station.
Precipitation:	Model 5050P	Sensor Orifice Diameter: 12" Ht. Orifice from ground: 13'8"
Soil Moisture :	Model 3051	Sensor
Transmitter:	Model 5050 Model 5050AO Model 5050CP	Transmitter Analog Option Connector Package and Signal Conditioning Card
Wind Direction:	Model 5050WD Output - 0 to 1,000 ohms	Sensor
Wind Speed Sensor:	Model 5050WS Output - AC voltage Threshold - 1.5 mph Range - 1.5 to 200 mph Distance Constant - 10 feet Turning Radius - 2.75 inches	

WEATHER STATIONS

ANACAPA ISLAND, East Island

Location	Near Ranger House
Elevation	45.7 m (150 ft.)
Longitude	119° 21.8'
Latitude	34° 01.0'

Sensors Present	Computer ID#
Wind Speed & Direction	187
Rainfall	190
Relative Humidity	191
Temperature	192
Soil Moisture	193
Barometric Pressure	194

Soil Moisture Sensor Location
2 m (6 ft.) South of Station
Depth of 30 cm (1 ft.)

Station Installed 01/31/85
Standard Height of 6.1 m (20 ft.)

SAN MIGUEL ISLAND

Location	San Miguel Hill
Elevation	253.3 m (831 ft.)
Longitude	122° 01.8'
Latitude	34° 02.0'

Sensors Present	Computer ID#
Wind Speed & Direction	167
Rainfall	170
Relative Humidity	171
Temperature	172
Soil Moisture	173
Barometric Pressure	174

Soil Moisture Sensor Location
1 m (3 ft.) South of Station
Depth of 30 cm (1 ft.)

Station Installed 09/10/85
Standard Height of 6.1 m (20 ft.)

SANTA BARBARA ISLAND

Location	Signal Peak
Elevation	190.2 m (624 ft).
Longitude	119° 02.2'
Latitude	33° 28.0'

Sensors Present	Computer ID#
Wind Speed & Direction	147
Rainfall	150
Relative Humidity	151
Temperature	152
Soil Moisture	153
Barometric Pressure	154

Soil Moisture Sensor Location
3.8 m (11 ft.) South of Station
at East Edge of Coastal Sage
Depth of 30 cm (1 ft.)

Station Installed 06/26/85
Station Height Altered to 4.9 m (16 ft.)
Above Ground Level.

SANTA ROSA ISLAND

Location	Between Soledad Peak and Black Mountain
Elevation	373.4 m (1,225 ft.)
Longitude	120° 05.3'
Latitude	33° 57.7'

Sensors Present	Computer ID#
Wind Speed & Direction	177
Rainfall	180
Relative Humidity	181
Temperature	182
Soil Moisture	183
Barometric Pressure	184

Soil Moisture Sensor Location
1 m (3 ft.) South of Station
Depth of 30 cm (1 ft.)

Station Installed 05/29/86
Standard Height of 6.1 m (20 ft.)

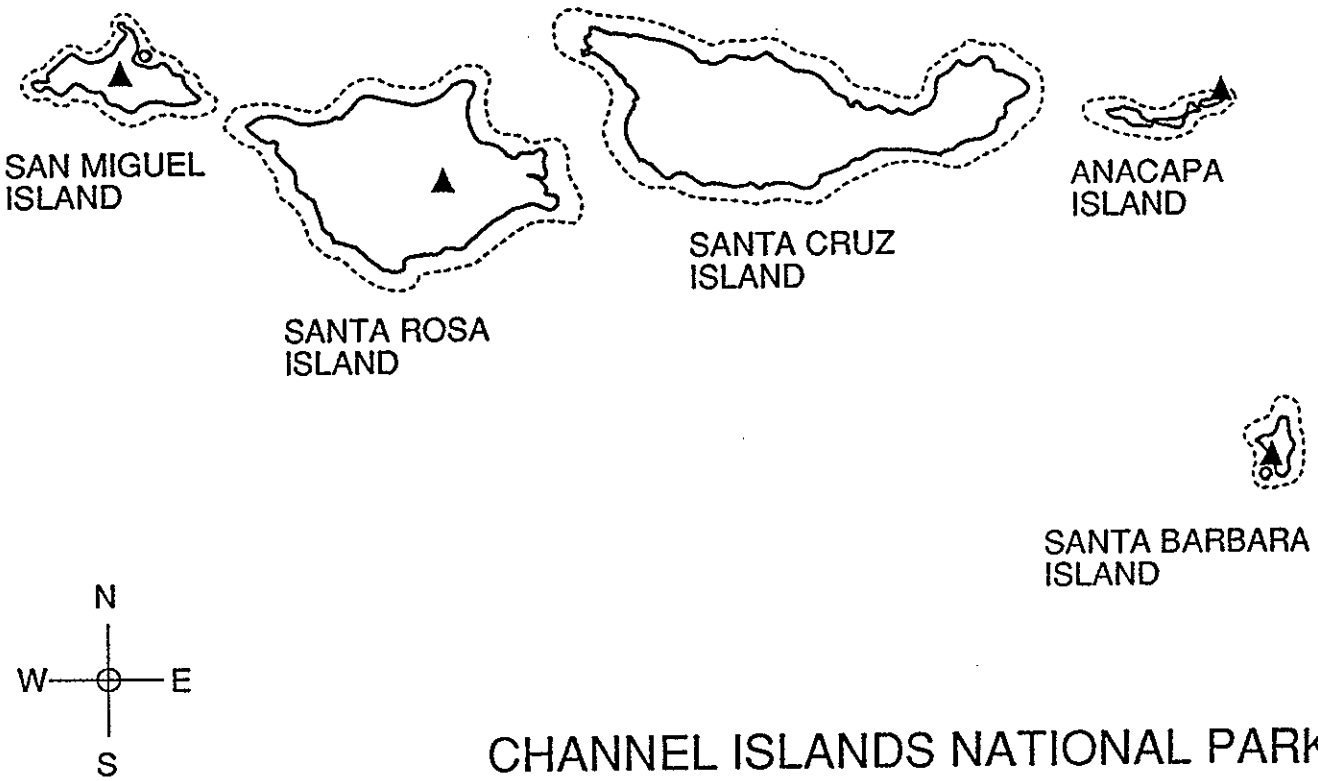


Figure 2. Map of Weather Monitoring Locations

WEATHER STATION MAINTENANCE

EQUIPMENT NEEDED

Located at Each Station:

12' Stepladder

Carried in Weather Toolbox:

Solder
Voltmeter
Soldering Iron
Thermometer
Butane for Soldering Iron
Compass
Crimping Tool
Dummy Load
Lugs and Connectors
Altimeter
Hacksaw and Hacksaw Blades
Two Allen Wrench Sets
Level
Needle Nose Pliers
Pocket Knife
Wire Cutters
Vise Grips
Small Files
Duct Tape
Wrenches
Electrical Tape
Measuring Tape
Silicone Caulking and Gun
Phillips & Regular Screwdrivers
Spare Cap for Temp/Humidity Sensor
Lubricant

Not in Toolbox:

Sandpaper and Rustproof Paint
Water and Clean Rags

In Addition, for Six Month Maintenance Schedule:

Batteries, Psychrometer, and Anemometer

Spare Parts List:

Model 1520 Barometric Sensor
Model 4550RS Radiation Shield
Model 5033-0.4 Solar Panel
Model 5050ANT Omni Antenna with Cable and Mounting Hardware - Specify Frequency
Model 5050HT Humidity/Temperature Sensor
Model 5050P Complete Tipping Bucket/Sensor
Model 5050WD Wind Direction Sensor
Model 5050WS Wind Speed Sensor
Antenna Mast
Antenna Mast Cross Pipe, Set of 2
Antenna Cable, 18 feet Long
Funnel with Screens
Funnel Screen - Large Outer
Funnel Screen - Small Inner
Relative Humidity /Temperature Sensor Cable
Sensor Arm Elbow Fitting
Sensor Arm Hose Clamp, Size 16 (3/4" to 1-1/2")
Sensor Arm Tee Fitting
Top Section with Funnel and Screen
Wind Direction Sensor Support Pipe
Wind Speed Sensor Support Pipe
Wind Sensor Signal Cable for both Direction and Speed

Nylon Rope

Spare Parts and/or Information May Be Obtained By Contacting:

SIERRA-MISCO, INC
1825 Eastshore Highway
Berkeley, California 94710
(415) 843-1282

GENERAL MAINTENANCE

MONTHLY MAINTENANCE

1. Unscrew two screws on radiation deflector plates and remove by sliding downward.

2. Unscrew black fluted, plastic cap from base of temperature/relative humidity sensor and replace with clean cap, being careful not to touch the sensor wires or to screw on too tightly. Retain the old cap to be cleaned later as follows:
   Soak in distilled water; clean, dry, lubricate and store for future use.

3. Clean solar panel with cloth and water.

4. Check level of rain gauge and clean funnel so as to be free of debris.

5. Check overall station for rust, deteriorating wires and corroded connectors.

6. Lubricate all bolts and nuts to prevent corrosion.

7. Make note of any problems to be repaired next servicing.

8. Complete Maintenance Record for station (see Appendix A for Maintenance Log).

SIX MONTH MAINTENANCE

Same as Monthly Maintenance schedule above plus the following:

1. Remove rain can and set on ground.

2. Remove the barometric pressure box and then the transmitter by pulling up with the nylon rope contained within the support housing.

3. Unscrew the rain gauge cable from the transmitter, being certain you do not tip the bucket before this is completed.

4. Clean entire rain gauge apparatus including the screen and tipping bucket.

5. Replace batteries:
   a. Slide batteries out of transmitter and unhook.
   b. Hook up new batteries.
   c. Check voltage to transmitter:
      Place voltmeter dials on DC and 20.
      Place black probe of voltmeter to TP1 pin on ID side of transmitter board.
      Place red probe of voltmeter to top red wire pin below TP1.
   d. Put batteries back in can, checking to make certain they are still connected.

6. Push "Test" button on bottom of transformer, then call headquarters to see if data was received instantaneously.

7. Verify data:
   a. Compare readings with thermometer, anemometer, and psychrometer.
   b. If not in agreement, recalibrate using directions found in Appendix B.

8. Lower the transmitter back into the cylinder and then replace the barometric pressure sensor.

9. Place the tipping bucket back in the rain can and make certain that it is level, using the leveling bubble on top.

10. Place the screen back on the rain can.

11. Place rain can back on top making certain that the tipping bucket is level by using the leveling bubble on top.

12. Complete Maintenance Record for station.

13. When back in office, check computer for erroneous data sent during maintenance period and edit out any extraneous test data.

DATA MANAGEMENT

Weather stations on the islands and in the local area transmit weather data receivable by an antenna on the Channel Islands National Park headquarters building. The computer operates 24 hours a day and receives and stores all incoming weather data.

Data Access Instructions

Section 1 gives you the identification numbers of both the weather stations and their individual sensors which you will need to refer back to in order to access the desired data. A copy of this information is also posted above the computer/monitor.

Section 2 will help you get started by accessing the "Data Display Programs" menu.

Section 3 describes in detail the ways of displaying the desired data.

Section 4 instructs you in how to use the printer for printouts of weather data.

Section 5 describes how others can access the weather data in this computer from another computer.

Section 6 tells you how to turn off the monitor when you are finished with the system. This is important!

If you need more information than what is provided in this handbook the International Hydrographic Services (Division of Sierra-Misco) documentation for the weather software is in the white binder near the computer.

For problems with the software, contact either:
Dave Leader or Brett Forrester
Sierra-Misco - Sacramento Division
916-929-8861.

Tell them our weather modum is (805) 644-8406. With this information they will be able to access the computer directly to lead you through any problems you may have.

For local help with the system contact:
Ms. Dolores Taylor, Sr. Engineer
Ventura County Flood Control District
(805) 654-2014.

SECTION 1. Group and Sensor Names and Numbers:

GROUP NUMBERS

It is possible to either obtain **ALL** weather factors from **ONE** place, i.e., Group 3, Santa Rosa Island, or obtain **ONE** weather factor for **ALL** places, i.e., Group 9, Temperature.

Group 1 - Santa Barbara Island Weather
Group 2 - Anacapa Island Weather
Group 3 - Santa Rosa Island Weather
Group 4 - San Miguel Island Weather
Group 5 - Ventura (County Center)Weather

The above Group Numbers display wind speed and direction, precipitation, relative humidity, temperature, soil moisture (except Ventura), and barometric pressure at each location, while the following Group Numbers will display individual weather factors at all locations:

Group 6 - Wind Speed and Direction

Catalina Island
Ventura
Santa Barbara Island
San Miguel Island
Santa Rosa Island
Anacapa Island
Santa Cruz Island

Group 7 - Precipitation

Santa Barbara
San Miguel
Santa Rosa Island
Anacapa Island
Santa Cruz Island

Group 8 - Relative Humidity

Ventura
Santa Barbara Island
San Miguel Island
Santa Rosa Island
Anacapa Island

Group 9 - Temperature

Ventura
Santa Barbara Island
San Miguel Island
Santa Rosa Island
Anacapa Island

Group 10 - Soil Moisture

Santa Barbara Island
San Miguel Island
Santa Rosa Island
Anacapa Island

Group 11 - Barometric Pressure

Ventura
Santa Barbara Island
San Miguel Island
Santa Rosa Island
Anacapa Island
Santa Cruz Island

SENSOR NUMBERS:

The following is a list of the sensors, their type and location as well as their individual code numbers which you will need in order to access data.

Catalina Island

100 = Wind Speed and Direction
103 = Precipitation

Ventura (County Center Building)

107 = Wind Speed and Direction
110 = Precipitation
111 = Relative Humidity
112 = Temperature
113 = Soil Moisture (not operating)
114 = Barometric Pressure

Santa Barbara Island

147 = Wind Speed and Direction
150 = Precipitation
151 = Relative Humidity
152 = Temperature
153 = Soil Moisture
154 = Barometric Pressure

San Miguel Island

167 = Wind Speed and Direction
170 = Precipitation
171 = Relative Humidity
172 = Temperature
173 = Soil Moisture
174 = Barometric Pressure

Santa Rosa Island

177 = Wind Speed and Direction
180 = Precipitation
181 = Relative Humidity
182 = Temperature
183 = Soil Moisture
184 = Barometric Pressure

Anacapa Island

187 = Wind Speed and Direction
190 = Precipitation
191 = Relative Humidity
192 = Temperature
193 = Soil Moisture
194 = Barometric Pressure

Santa Cruz Island

540 = Wind Speed and Direction
543 = Precipitation

SECTION 2. Accessing the Menu:

For BEGINNERS

The CURSOR: is the flashing dash you see on the screen. When you press a key on the keyboard, it will show on the screen where the cursor was located and the cursor will move one space to the right.

The ENTER (or Return) Key must be pressed after any instructions you give the computer (such as "login" or "user").

The four ARROW keys move the cursor around on the screen so you can place the cursor where you wish to make a data entry. When using these arrow keys to move the cursor, nothing else is happening... you are just moving the cursor. These arrow keys are also the numbers 4, 8, 6 and 2 if the "NUM LOCK" key is engaged. If you are getting a number instead of moving the cursor, press **NUM LOCK** and this will put you back to the arrow keys or visa versa.

Another key marked with a left arrow is the BACK-SPACE key which is located at the end of the top row, just to the right of the + = key. This key moves the cursor to the left BUT AT THE SAME TIME IT ERASES WHATEVER IS JUST TO THE LEFT OF THE CURSOR, thus, in effect, erasing BACK-WARDS.

The DEL key (Delete) erases whatever the cursor is marking, and this continues in such a manner as to erase FORWARD.

NUMBER KEYS - You have a choice to use either the numbers appearing across the top of the keyboard, or the "adding machine-like" keys on the right end of the keyboard. Some people prefer to use the top numbers for numbers and leave the right end just for the arrow functions. If, however, you are familiar with a 10-key adding machine and have a large group of numbers to be entered, it is generally faster to use the right end keyboard by engaging the **NUM LOCK** key.

If the screen seems to be stuck - pressing a key does not do anything, and the cursor will not move - hold down **CTRL** and press **BREAK** (Scroll Lock) key at the same time. This will give you a #, $ or % sign in the lower left corner of the screen. Type **login** and **user** and press **Enter**.

ESC KEY (Escape) must be used to exit whatever you are doing and get back to the DATA DISPLAY PROGRAMS menu. You may be asked if you want to "Execute? (y/n)", answer "n". If you press the ESC key when you are already at the MASTER or DATA REPORT PROGRAMS menus, you will get a $ or % sign. Type **user** and press **Enter.**

If you accidentally ESCape from the menu, you will see a #, $ or %. Type **login** and **user** and press-**Enter.**

CAPSLOCK KEY switches you to all upper case or lower case letters, but DOES NOT AFFECT the !@#$%^&*()_+}{":? keys which are obtained by using the "Shift" key.

PRTSC KEY (Print Screen) is for printing whatever appears on the screen. Hold down **CTRL, ALT** and **PRTSC** together and then release. This will print exactly what is shown on the screen. If the printer fails to function immediately, make certain:

- It is turned on (small green light will show beside the word "Power") and is joined to the weather computer, not to the computer on the right which is used by research.

- The small green light next to SEL (Select) is on. If you have opened the printer for any reason, the SEL light may be off - simply press the **SEL** button and the printer will start.

(Go to Section 4 for more complete instructions concerning the use of the printer.

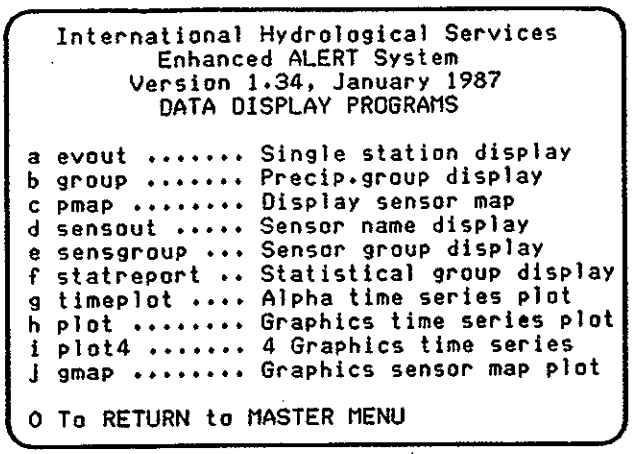
GETTING STARTED

Not Normal - computer and monitor both turned off.

The computer assigned to weather data accumulation is supposed to run 24 hrs. a day. If, however, it has accidentally been turned off,

- Turn computer on (switch on back right side), and turn the screen on by using the "Pull-On" switch on front of monitor. The system will go through a number of checks and give you a **login:** prompt. Type **user** and press **Enter.**

You will get the "DATA DISPLAY PROGRAMS" menu as shown in Example 1. Go on to Section 3.



Example 1.

Normal - computer is running but monitor is off.

- Turn on the screen using the "Pull-On" knob on front of monitor.

The screen should have the "DATA DISPLAY PROGRAMS" menu as shown in Example 1, go on to Section 3.

If the screen has the "MASTER MENU" or "DATA REPORT PROGRAMS" menu there will also probably be a $, # or % sign in the lower left hand corner. If this is the case,

- Type **login** (lower case) and **user** and press **Enter**. Go on to Section 3.

If the screen shows an A or C on the lower left side

- Press **ALT** and **DEL** at the same time, release. You will get an orange, blue, and black screen. Press **9** and then the **Enter** key.

You will get a $, #, or % prompt on the lower left hand corner,

- Type **login**, and press **Enter**; type **alert** and **Enter**; type **help** and **Enter**.

You should now have the "MASTER MENU" or "DATA REPORT PROGRAMS" on the screen and a $ in the lower left corner.

- Type **login** and press **Enter**. Type **user** and press **Enter**.

This will give the "DATA DISPLAY PROGRAMS" menu as shown in Example 1. Go on to Section 3.

SELECTIONS -

The menu shown in Example 1 allows you to select how you would like to see the weather data.

The options which are the best for viewing Channel Islands and vicinity weather data are:

a - to display a single sensor at a time (see list of sensor numbers in Section 1).

e - to display a group of sensors (see list of group numbers in Section 1).

f - to display averages, minimums or maximums for sensors over a specified period of time.

h - plot one or two sensors on a line graph.

i - plot one to four sensors on a line graph.

Details on how to use each of these options follows in Section 3.

SECTION 3. How to Retrieve Desired Data:

```
            International Hydrological Services
                  Enhanced ALERT System
                Version 1.34, January 1987
                  DATA DISPLAY PROGRAMS

          a evout ....... Single station display
          b group ....... Precip.group display
          c pmap ........ Display sensor map
          d sensout ..... Sensor name display
          e sensgroup ... Sensor group display
          f statreport .. Statistical group display
          g timeplot .... Alpha time series plot
          h plot ........ Graphics time series plot
          i plot4 ....... 4 Graphics time series plot
          j gmap ........ Graphics sensor map plot

          0 To RETURN to MASTER MENU

   Strike the key for the desired utility or <ESC> to exit ->
```

If you select **a single... Single station display,** (which the National Weather Service calls **evout** for "Event Out") you will obtain the following:

```
          Enter Command Options.   Press F1 to EXECUTE.
      Program: evout
          Enter ending date                (MM DD YY) ->
          Enter ending time                    (HHMM) ->
          Enter starting date              (MM DD YY) ->
          Enter starting hour                    (HH) ->
          Enter number of entries to display          ->
```

If you press **Enter** after each line, it will ask you for the sensor number you wish to see and give you the latest data for that sensor. (Sensor 152 was selected for this example.)

```
                                                Aug 18 88  7:43:09
Sensor # 152 Santa Barbara Islan Temperature Sensor
  DATE    TIME  degrees F
  08/18   0703       76
  08/18   0601       75
  08/18   0459       75
  08/18   0358       75
  08/18   0256       73
  08/18   0154       74
  08/18   0052       75
  08/17   2350       75
  08/17   2248       73
  08/17   2146       71
  08/17   2044       67
  08/17   1942       64
  08/17   1840       60
  08/17   1739       62
  08/17   1637       65
```

If you want to see data from some other time period, enter in the ending data and hour and the starting date and hour of the time period you want to see. Dates are entered with a space between the month, day, and year. If you do not enter the ending hour and starting hour, the program will assume the last hour available.

```
                                                    Aug 18 88  7:51:28
Program: evout
    Enter ending date                    (MM DD YY) -> 08 10 88
    Enter ending time                       (HHMM) -> 2400
    Enter starting date                  (MM DD YY) -> 08 10 88
    Enter starting hour                        (HH) -> 01
    Enter number of entries to display           ->

  Sensor # 540 Santa Cruz Island Wind Sensor
    DATE         TIME     speed   direction
    08/10      23:49:16     3.5 mph 140 deg (25)
    08/10      23:38:28     3.3 mph 130 deg (24)
    08/10      23:27:20     2.9 mph 130 deg (23)
    08/10      23:14:31     2.8 mph 150 deg (22)
    08/10      23:01:18     3.6 mph 130 deg (21)
    08/10      22:50:53     3.6 mph 120 deg (20)
    08/10      22:40:34     3.1 mph 150 deg (19)
    08/10      22:28:28     0.7 mph 150 deg (18)
    08/10      21:38:40     2.8 mph 130 deg (17)
    08/10      21:25:14     2.6 mph 060 deg (16)
```

If you select d sensout... Sensour name display, you will obtain a list of sensor names and numbers. (It is easier and faster to simply look up this information either in Section 1 of this handbook or refer to the sheets on the wall above the computer monitor.)

```
                                                    Aug 18 88  8:06:00
Program: sensout
    Enter s to sort sensors by number              -> s
    Enter sensor type to display (? for list) -> ?
Sensor Type # .... Sensor Type Name
         0         Stream Gage Float
         1         Temperature Sensor
         2         Precipitation Gage
         3         Snow Sensor (water equiv.)
        19         Wind Sensor
        20         Relative Humidity Sensor
        22         Barometric Pressure Sensor
        23         Stream Gage PT
        24         Soil Moisture
      Please enter the sensor type # (ESC to exit)
```

Number 19 was chosen for this example:

```
                                                    Aug 18 88  8:06:49
     IHS: Sensout
       31 sensors defined in database
       107    Ventura County Cent    Wind Sensor
       147    Santa Barbara Islan    Wind Sensor
       167      San Miguel Island    Wind Sensor
       177      Santa Rosa Island    Wind Sensor
       187         Anacapa Island    Wind Sensor
       540      Santa Cruz Island    Wind Sensor
```

If you select e **sengroup... Sensor group display,** you will obtain the following:

```
                                                    Aug 18 88  8:18:13

Program: sensgroup
    Enter group number                  (0 for list) -> 1
    Enter ending date                     (MM DD YY) -> 07 10 88
    Enter ending time                         (HHMM) -> 2400
    Enter time step [m | h | d]                      -> 1h
    Enter number of periods to display               -> 24
    If you want printer output, enter    p           -> p
```

You then may choose either to enter a group number such as Group 1 for Santa Barbara weather.

```
                                                    Aug 18 88  8:25:26

                          Group Name
                  Santa Barbara Island Weather
            # 147    # 150    # 151    # 152    # 153    # 154
Data for    wind     precip   rhumid   temp     soil     baropr
 7/10/88    mph        in     rh%      degF     %        mb
2400          3      0.00     0.957     59.      4.7     1022.0
2300          4      0.00     0.441     64.      4.7     1022.0
2200          5      0.00     0.539     63.      3.9     1022.3
2100          7      0.00     0.730     61.      5.1     1021.0
2000          9      0.00     0.699     62.      4.7     1020.7
1900         10      0.00     0.918     60.      4.3     1019.7
1800         11      0.00     0.996     63.      4.3     1018.3
1700         10      0.00     0.996     64.      5.5     1018.3
```

Or, say, Group 9 for the Temperature from all the islands.

```
                                                    Aug 18 88  8:26:18

                          Group Name
                          Temperature
            # 152    # 192    # 172    # 182    # 112
Data for    temp     temp     temp     temp     temp
 8/10/88    degF     degF     degF     degF     degF
2400          59       58       59       61       59
2300          60       59       61       61       59
2200          59       59       60       60       59
```

If you enter a group number and then press the return key after the remaining questions, you will get a group display of the most recent data by hour. If you want to see data from an earlier date, enter the date and the last hour of that date you wish to see.

Time step: specifies whether the data will be displayed in minutes, hours, or days and should be entered as (number of)m, or (number of) h, or (number of)d. i.e. 24h; 30d; etc.

Number of Periods: is the total number of time steps to display.

If you select **f statreport... Statistical group display**, you will obtain,

```
                                                    Aug 18 88  8:31:48


  Program: average
  Enter group number                                -> 1
  Enter ending date    (MM DD YY)                   -> 9 30 85
  Enter ending hour (HH)                            -> 24
  Enter time step [m ; h ; d]                       -> 1d
  Enter number of periods to display                -> 30
  If you want printer output, enter     p           -> p
```

With this program you will get a maximum value, minimum value, and an average value for each sensor in the group over the specified period of time. Questions are answered in the same manner as for **e group**. For these averages the time step would be 1d (one day) and the number of periods would be however many days you wish to see displayed, i.e. 30 (30 days).

```
                                                    Aug 18 88  8:32:44
            # 147     # 150     # 151     # 152     # 153     # 154
Date/Time   11/27     11/27     11/27     11/27     11/27     11/27
Data for     wind     precip    rhumid     temp      soil     baropr
24 hours     mph        in      rh%       degF      % s        mb
 9/30/85
     Max     12.8     _____     1.00      68.0     255.0     1027.3
     Min      0.0     _____     0.88      60.0     255.0     1021.7
     Avg      6.6     _____     0.98      63.1     255.0     1025.2
 9/29/85
     Max      7.2     _____     1.00      64.0     255.0     1027.3
     Min      0.0     _____     1.00      60.0     255.0     1024.7
     Avg      3.2     _____     1.00      61.9     255.0     1026.2
 9/28/85
     Max     14.6     _____     1.00      65.0     255.0     1024.3
     Min      0.0     _____     1.00      59.0     255.0     1022.0
     Avg      6.9     _____     1.00      62.2     255.0     1022.7
 9/27/85
     Max     14.2     _____     1.00      73.0     255.0     1023.7
     Min      0.0     _____     0.82      63.0     255.0     1019.0
     Avg      7.2     _____     0.99      64.8     255.0     1021.9
 9/26/85
     Max      8.1     _____     1.00      71.0     255.0     1025.0
     Min      0.0     _____     0.81      63.0     255.0     1021.7
     Avg      4.2     _____     0.96      65.7     255.0     1023.4
 9/25/85
     Max      8.9     _____     1.00      76.0     255.0     1024.3
     Min      0.0     _____     0.90      65.0     255.0     1019.0
     Avg      5.7               0.98      68.5     255.0     1022.2
```

If you select **h plot... Graphics time series plot** you will obtain,

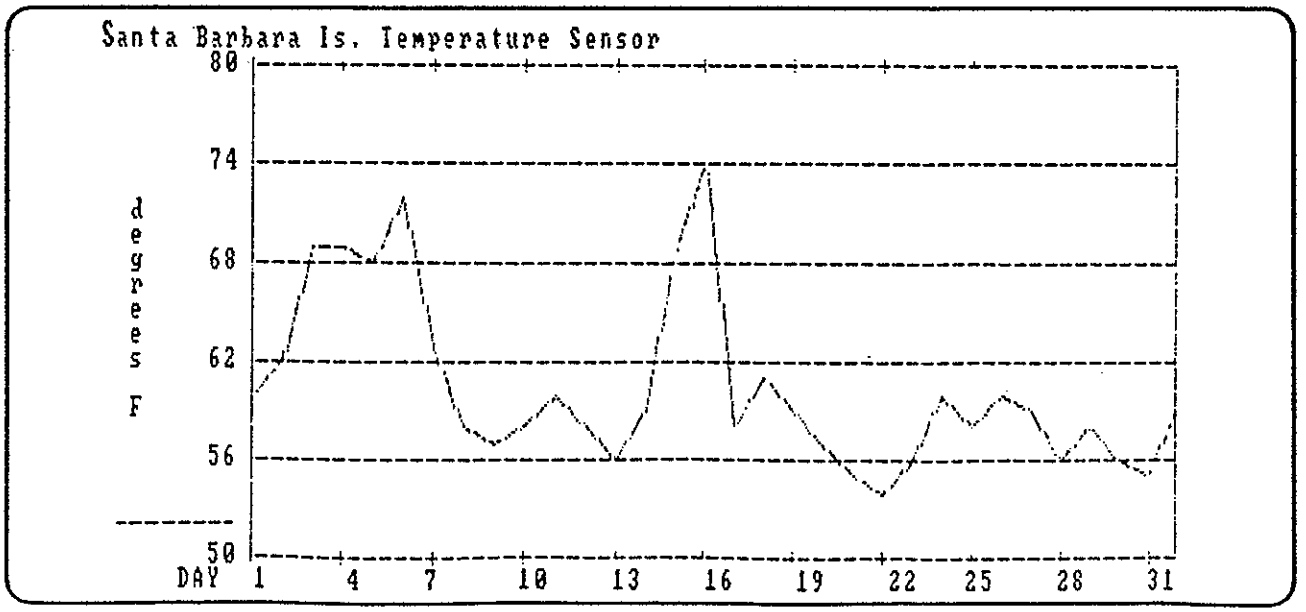
```
                                                    Aug 18 88  8:35:12

     Program: plot
     Enter plot type [ 1=color 2=hirez ]        -> 2
     Enter sensor number(s)                     -> 152
     Enter ending date   (MM DD YY)             -> 10 31 85
     Enter ending hour (HH)                     -> 24
     Enter time step [m ¦ h ¦ d]                -> 1d
     Enter number of days to display            -> 31
     Enter number of extents  (DEFAULT = 0)     ->
```

This program will give you a line graph of data over a specified period of time for one or two sensors.
Color: is best for viewing on the screen.
Hirez: is black and white high resolution, which is best for printing and will fit twice as many data point on the graph as would color.
Ending date and hour: are the last date and hour for which you wish to see data.
Time step: is the time increment (assumed to be hours unless other wise specified).
Number of days to display: is self explanatory.
Number of extents: allows you to view data on the graph a specified number of days before or after the date indicated. You can see data before and after the date specified by striking the left or right arrow key depending on which way you want to go. The plot is shifted by one quarter of the screen with each arrow key entry. To change the "jump size" from quarter screen, use the number keys. For example, to jump a full screen of data at a time, press the 4 key, then the desired arrow key. Exit a plot by striking either the Enter key or ESCape key.

Line designations for the plot are located in the lower left and right corners of the screen. Labels for the sensors are located on the top left and right. The first sensor specified will be on the left.

To print the plot as shown on the screen, hold down the CTRL, ALT, and PRTSC keys together.



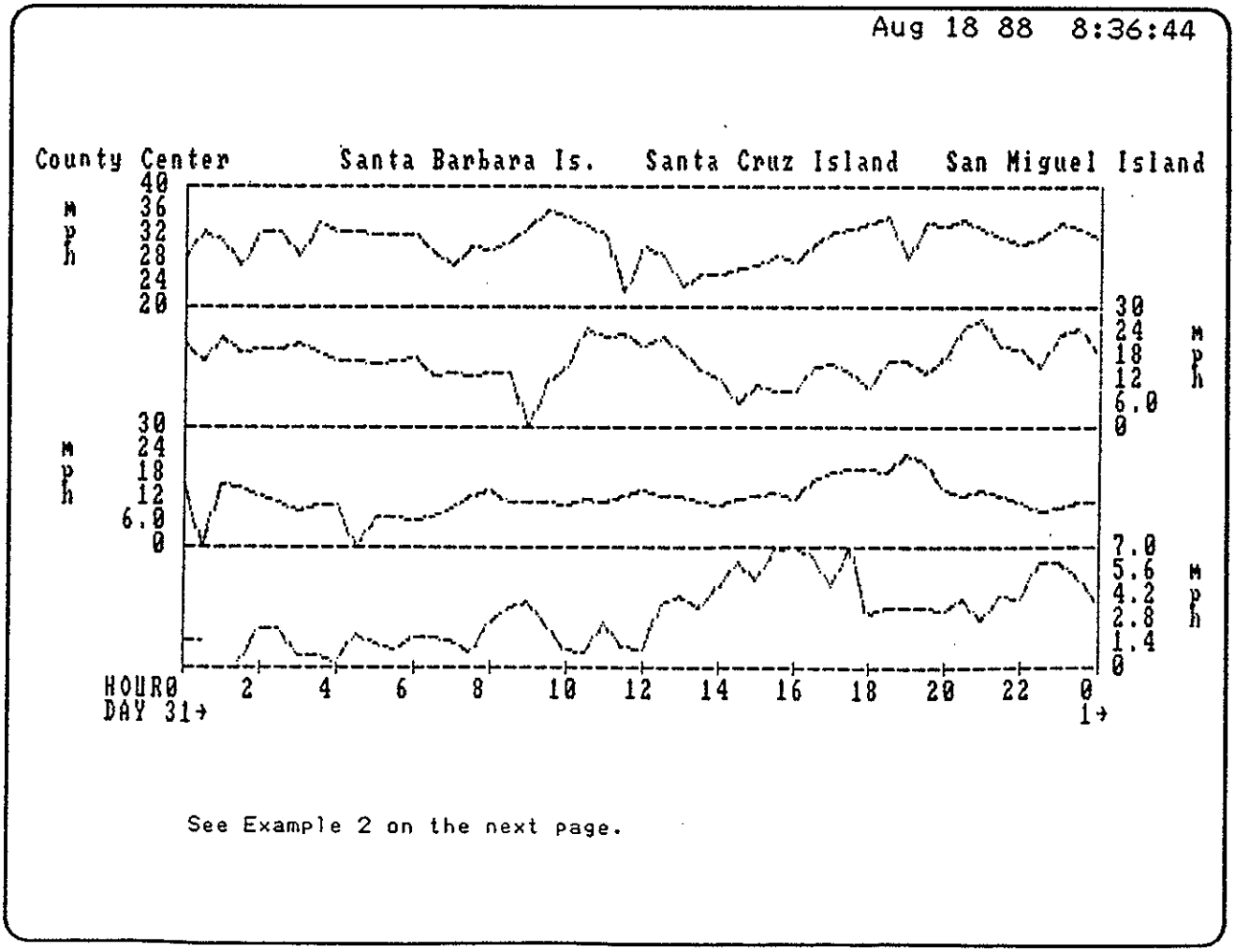
If you select **i plot 4... 4 Graphics time series plot**, you will obtain:

```
                                                    Aug 18 88  8:35:45
Program: plot4
Enter plot type [ 1=color 2=hirez ]          -> 2
Enter sensor number(s)                       -> 107 147 540 167
Enter ending date   (MM DD YY)               -> 10 31 85
Enter ending hour (HH)                       -> 24
Enter time step [m ; h ; d]                  -> 1h
Enter number of days to display              -> 1
```

With this program you are able to display up to four sensors at one time. Each is scaled and labeled in its own individual graph, and plotted one graph above the other.

The first sensor specified is the bottom graph with the sensor name on the upper left. The second sensor is the second graph from the bottom, with the name the second from the upper left, etc. The questions are answered the same as in option "h" above. To print, hold down the CTRL, ALT, and PRTSC keys simultaneously.

Following are two examples of this program:
The first asks for wind speeds on October 31, 1985, (a predicted Santa Ana wind day) at Ventura and Santa Barbara, Santa Cruz, and San Miguel islands. The first sensor specified will be on the bottom of the graph.

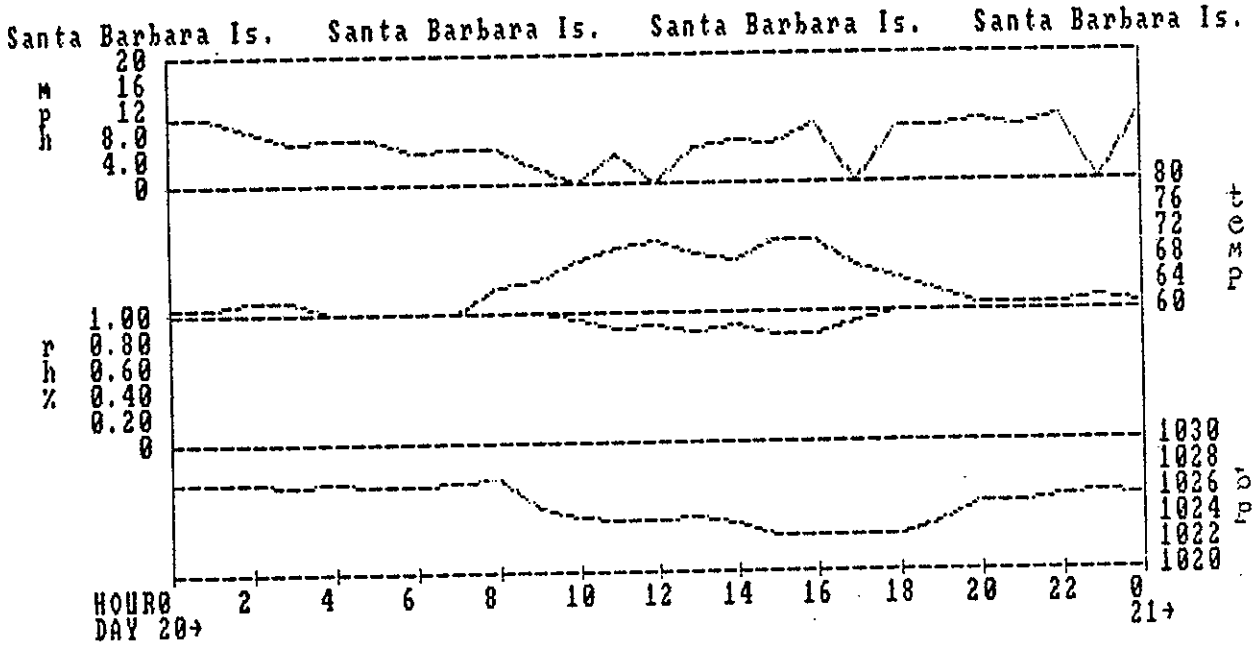


See Example 2 on the next page.

The second example shows how to get the weather conditions (wind, relative humidity, temperature, and barometric pressure) at Santa Barbara Island on September 20, 1985.

```
                                                    Aug 18 88  8:39:46

Program: plot4
Enter plot type [ 1=color 2=hirez ]          -> 2
Enter sensor number(s)                       -> 154 151 152 147
Enter ending date   (MM DD YY)               -> 9 20 85
Enter ending hour (HH)                       -> 24
Enter time step [m ; h ; d]                  -> 1h
Enter number of days to display              -> 1
```



SECTION 4. Operating the Printer:

The printer for the Channel Islands National Park weather monitoring computer is an NEC P3. This is a Near Letter Quality Dot Matrix printer. The on/off switch is on the back right side. Following is a description of the indicator lights and buttons on the top of the printer:

Indicator Lights -

- **Power** - green light means power means power is on.
- **SEL** - green light means printer is ready to print.
- **P. E.** - red light means printer is out of paper.

Switches -

- **FONT** - press to select font type (see font digital indicator inside of printer under cover). SEL light must be off to change font. See examples of font types below.
- **SEL** - press to turn light off (or on) so as to be able to use other switches.
- **TOF** - press to automatically feed paper to top of the next sheet. The top of the sheet can also be set using the roller knob on the right side of the printer. (The SEL light must be off in order to do this.)
- **LF** - press to automatically feed paper line by line. (The SEL light must be off for this function.)

Font Types and Their Numbers:

1 This is an example of font 1, PICA CORRESPONDENCE QUALITY.

2 This is an example of font 2, PICA NEAR-LETTER QUALITY.

3 This is an example of font 3, ELITE CORRESPONDENCE QUALITY.

4 This is an example of font 4, ELITE NEAR-LETTER QUALITY.

5 This is an example of font 5, PROPORTIONALLY SPACED CORRESPONDENCE.

6 This is an example of font 6, PROPORTIONALLY SPACED NEAR-LETTER.

7 This is an example of font 7, CONDENSED PRINT.

0 This is an example of font 0, PICA HIGH SPEED.

SECTION 5: Accessing Channel Island NPS Weather Data from Another Computer:

The Channel Islands Weather Monitoring System can be accessed by most other computers or printers via a telephone modem connection. The interested party must have a minimum of a 300 baud acoustical modem and a printer. A computer with a 1200/300 baud modem is preferred for easier access and speed.

This weather computer will recognize the following terminal parameters:

- 300 or 1200 baud rate
- Even or no parity
- 7 or 8 data bits
- 1 stop bit.

For an interested party to call up this computer they should....

Dial (805) 644-8406. Once they are connected they should press their **Enter** key.

They will see a **Login:** prompt. They must type **user** to reach the "Data Display Programs" described in detail in Section 3. You can lead them thru the program using Section 3 of this handbook as a guide.

SECTION 6. When You are Finished:

Press ESCape once.
This will return you to the "Data Display Programs" menu. Simply turn off the monitor by pressing in on the **Pull On/Push Off** button.

Please, NEVER TURN OFF MONITOR UNTIL YOU HAVE THE "DATA DISPLAY PROGRAMS" MENU ON THE SCREEN.

APPENDIX A. STATION MAINTENANCE LOG

MAINTENANCE LOG

Station Santa Barbara Island

Date	Type of Service Performed
6·26·85	Installed Station
8·23·85	changed transmitters (to report every 5mph) as requested by county
12·17·85	Changed transmitters (to report every 1mph) (as requested by Nat'l Weather Service)
12·18·85	Transmitter installed 12·17, non-functional Researched retrieval transmitter & reinstalled. Batteries changed.
3·19·86	Brass cap changed.
3·27·86	Temp looks okay, rh looks bad. Contact Sierra/Misco.
12-6 & 12-10-86	Don Lee painted weather station (2 coats of primer; 3 coats of finish)
10-23-86	6-month maintenance; changed batteries
3-9-87	Lewis changed teflon cap
11-4-87	6-month maintenance; changed batteries

EXAMPLE

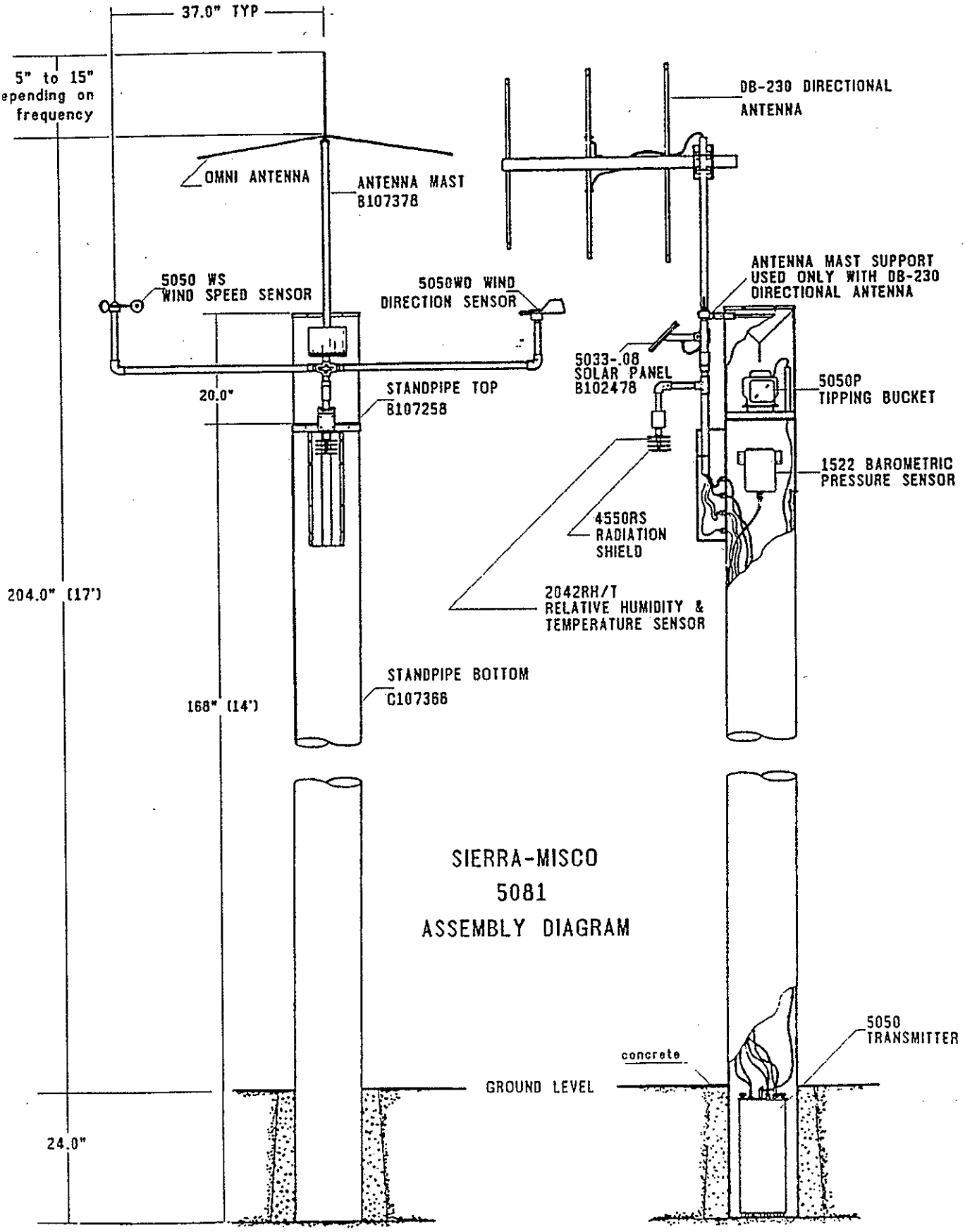
APPENDEX B.

TECHNICAL DESCRIPTIONS OF SENSORS

INDIVIDUAL MAINTENANCE REQUIREMENTS
AND
TROUBLESHOOTING TECHNIQUES

MODEL 5081

REAL TIME EVENT REPORTING WEATHER STATION


37.0" TYP
5" to 15"
epending on
frequency
OMNI ANTENNA
ANTENNA MAST
B107378
DB-230 DIRECTIONAL
ANTENNA
5050 WS
WIND SPEED SENSOR
5050WD WIND
DIRECTION SENSOR
ANTENNA MAST SUPPORT
USED ONLY WITH DB-230
DIRECTIONAL ANTENNA
5033-.08
SOLAR PANEL
B102478
5050P
TIPPING BUCKET
20.0"
STANDPIPE TOP
B107258
1522 BAROMETRIC
PRESSURE SENSOR
4550RS
RADIATION
SHIELD
204.0" (17')
2042RH/T
RELATIVE HUMIDITY &
TEMPERATURE SENSOR
STANDPIPE BOTTOM
C107366
168" (14')
SIERRA-MISCO
5081
ASSEMBLY DIAGRAM
5050
TRANSMITTER
concrete
GROUND LEVEL
24.0"

SIERRA/MISCO, INC.
BASIC GAUGE INSTALLATION
INSTRUCTION MANUAL, Document #A102791

1.0 INTRODUCTION

The Real Time Event Reporting Stations are totally self-contained packaged stations used to automatically report from remote sites to a central site. The main housings act as the antenna tower and weather proof housing for the electronics package and must be installed correctly to achieve proper operation.

2.0 SITE SELECTION

2.1 The operation of self-reporting data collection system is dependent upon the transmission of radio signals from the event reporting gauge site to the radio receiver station. A clear radio path between the transmitter and the receiver with no intervening obstructions is referred to as a "line of sight radio path". It is desirable to have all radio paths in a system be line of sight. If line of sight radio paths are not used, some loss of data can be expected, especially during poor transmission times such as clear, hot periods. It is possible this loss of data will effect the accuracy of your forecasts. Where line of sight radio paths do not exist between the reporting gauge and the receiving station, a repeater site can be established.

2.2 Radio communications can be affected by many factors: Terrain features such as mountains and the natural curvature of the earth's surface. Heavy stands of timber and other vegetation which can block signals with increasing effectiveness as they become wet or snow covered. Large masses of metal adjacent to the transmission path in the vicinity of the transmitter which can reflect and/or interfere with radio transmissions. Temporary signal absorption by personnel in close proximity to the antenna. Atmosphere conditions which reflect or refract the radio path from its normal propagation path. Reflection generally takes place from a cloud layer and for rainfall data generally enhances the received signal. Refraction which causes a deterioration of the signal will be most prevalent during hot, dry summer afternoons. Temporary signal loss during hot, dry weather does not impact precipitation data collection ability but may be significant for a stream gauge.

This manuals includes:

6 pages Text
A101019 Radio Path Check List

2.3 Although gauges can be effectively sited using topographic maps, to verify "line of sign" radio paths, the exact placement of the gauge at a site must always consider local obstructions (hills, knolls, trees, heights of structures) which are not indicated on topographic maps. Where uncertainty exists, radio paths can be verified by radio voice communication between the proposed gauge site and the receiving station. When running radio path tests on paths which are not line of sight, or it is uncertain if paths are line of sight, an 18 db fade margin is recommended. To accomplish this fade margin if field strength meters are not available, use omni antennas and lower power transmitters than will be used in the final configuration. For example, if a 4 watt transmitter with zero gain omni antennas at both receiver and transmitter enables a signal to just break squelch, then the addition of 6 db high gain antennas at both receiver and transmitter plus use of 8 watt instead of 4 watt transmitter will give 15db fade margin.

Receive antenna	6 db
Transmit antenna	6 db
Power 4 to 8 watts	3 db
Total Margin	15 db

Frequently a change of 10 or 20 feet in the proposed location is sufficient to bypass an obstruction between the transmitter and receiver.

2.4 The selection of the reporting gauge site should also give consideration to other data collection system factors: Permanency in order to insure a long, stable data record. Access to the site for installation and maintenance. Natural hiding ability to reduce vandalism. Potential future obstructions such as building sites and vegetation growth as well as future obstructions along the radio path. Areas which have tall trees should be taken into account when plotting and testing radio paths. If trees are deciduous (seasonally without leaves), test should be done when the trees have their full foliage.

2.5 In terms of system installation, the system can be on line more quickly and efficiently if the central data collection site is installed first and its receiving station operation verified before field work begins. All radios which report directly to the central site, including repeaters, should then be installed. Finally, those sites which require repeater radio paths should be installed.

2.6 After choosing the site and prior to gauge installation, the radio path should be verified by data (preferably) or voice communication between the proposed gauge site and the receiving station. The verification should be done on approximately the same frequency that the system will be using. Occasionally a high gain antenna and/or a higher tower will be installed at river gauge sites in order to get signals through with good reliability. Normally radio path work should be done under less

favorable conditions than will be encountered during critical operating times. It is recommended that radio paths be checked in clear warm weather.

3.0 INSTALLATION

3.1 On arrival at the site, unpack the contents of the boxes. Refer to the Assembly Diagram for the gauge being installed. Be sure to remove all items that are packed inside the standpipe.

3.2 While one or two installation team members begin digging the hole another team member inventories and checks the equipment. Refer to the manual(s) for the equipment being used for test procedures.

3.3 The hole for the gauge is normallly 24" deep with a diameter of about 24 inches. In areas of no frost the sides can be straight. In areas with frost the sides should slope outward from top to bottom with the bottom diameter several inches larger than the top. After the hole is dug, put some loose dirt in the bottom, add water and tamp the base flat and level. This is necessary to insure maximum contact between the bottom of the gauge and the ground for lightning strike grounding protection. In heavy frost areas it may be necessary to dig the hole deeper than 24 inches, refer to local building codes if you are unsure.

3.4 It is usually easiest to assemble the antenna mast and antennas and any external equipment to the standpipe prior to putting the standpipe into the ground. Begin by attaching antenna cable to the antenna. Place silicone grease around the male threads of the antenna connector on the antenna, taking care not to get any on the center element. Secure the antenna cable connector to the antenna. Route the antenna cable to the antenna mast base enclosure by threading the cable through the antenna mast. The cable for directional antennas can be routed outside alongside the antenna mast and secured with tie wraps. Refer to Assembly Diagram for the specific gauge being installed. Then attach antenna to the mast with the U bolts and hardware provided. When installing gauges with precipitation sensors, the antenna must be positioned on the mast so that the ground plane radials will not be over the gauge orifice when mounted to the gauge. When using an omni antenna only 3 of the ground plane radials are connected to the antenna. The fourth is kept as a spare. If a directional antenna is used, attach to the mast with mounting gear provided so that when the gauge is installed in the ground the antenna will point in the correct direction.

3.5 Feed the cables from the antenna mast section through the strain relief couplings near the top of the standpipe leaving U-shaped sections of cable on the outside for a drip line. If the gauge being installed has more than one cable in the antenna mast section it is best to thread first the cable which goes through

the topmost strain relief and work downwards, ending by threading the last cable through the bottommost strain relief. For example, on the 5081 weather station there are numerous cables which are routed into the standpipe as follows: The solar panel cable is threaded through the top strain relief. The antenna cable is then threaded through the strain relief next underneath. Then, working downward, the wind sensor cable, temperature and humidity cable, and finally any other optional sensor cables through the bottom strain relief. Then secure the antenna mast assembly to the side of the standpipe with 8 allen screws. It is best to start all 8 allen screws prior to tightening them.

3.6 If the gauge being installed has external wind sensor arms, use a carpenters level and adjust the sensor arms until sensor support pipes are straight up and perpendicular to the ground. Be sure to tighten all set screws once this is done. Align the wind direction sensor with respect to north by loosening the three set screws on the side of the sensor support pipe and facing the scribed "N" on the side of the sensor towards north. Then tighten the set screws, taking care that the sensor orientation does not change.

3.7 If the gauge being installed has a solar panel, it should be mounted so that it will receive maximum sunlight throughout the year. In the Northern Hemisphere it should face south and in the Southern Hemisphere it should face north. In choosing a site, such variable conditions as overhead obstructions, shadows, and the relatively lower arc of the sun in winter must also be considered.

3.8 Begin mixing the concrete. If rock rubble is available to steady the gauge, the mix can be more fluid. If rock rubble is unavailable, use a slightly drier mix for faster setting. Place the gauge in the hole with the base plate making good contact with the ground. Improved contact may be made by putting soft or wet soil on hole bottom. This increases chances of station surviving lightning strike. In areas of extremely high lightning potential, lightning rods are recommended to be installed at the base of the gauge. When positioning the gauge over the hole, several factors must be considered: orientation of solar panel, orientation of directional antenna, if gauge has precipitation sensor antenna must not obstruct orifice and orientation of antenna mast in relation to orifice should be positioned so that the antenna mast is on the side of the gauge away from the prevailing wind direction during most storms. Place approximately 6 inches of dirt-free rock rubble around the gauge, taking care not to dent the aluminum. Add concrete while maintaining the gauge in a vertical position. Use a carpenter's level to verify maintaining a vertical gauge position while alternately adding 6-inch layers of rock rubble and concrete. Each layer of concrete should be tamped to assure elimination of temporary voids. When the concrete is slightly above ground level, slope it away from the gauge using a trowel. This will direct water away from the base of the gauge. If rock rubble is not available, the gauge may be set completely in concrete. This

will require an additional 2 sacks of concrete. When the base section of the gauge is rigid, proceed with the installation.

3.9 Extra care should be taken in connecting the antenna cable, sensor cables, solar panel and battery to the electronics package. First untangle all the cables and neatly arrange them parallel to each other. Connect the antenna cables first. Then connect the battery leads from the electronics package to the battery observing correct polarity; red to positive, black to negative. Finally, connect the solar panel and sensor cables, taking care to keep the cables from getting snarled or tangled. When all the cables are attached, place a cable tie approximately every 12 inches along the cables to keep them from becoming tangled.

3.10 Verify all internal settings of the electronic package are set properly and/or reset, check signals with wattmeter or remote station tester as described in manual for electronics package in use. Then place into the protective housing and secure tightly with the two latch knobs. Attach the lifting rope to the handle on the top of the electronics package securely; if the rope becomes separated from the handle, the electronics package may be difficult to retrieve from the bottom of the standpipe. Drop scraps of foam or other cushioning material into the bottom of the standpipe and carefully lower the electronics package into the standpipe using the lifting rope to keep the strain off the cables. Place top section or cap onto standpipe and secure into place with the four allen screws provided.

4.0 INSTALLATION CHECKLIST

4.1 Pre-Site Check

Site use and access authorization
Radio frequency licensing
Radio path verification
Site characteristics (trees, structures, etc.)

4.2 Equipment Condition Check

Battery charge
Sensor calibration
Electronics Package operation

4.3 Suggested Installation Equipment Checklist

Remote station tester or tuned radio
Watt meter
Ladder
Square, flat shovel
Heavy breaker bar
Tamping tool
Pruning shears
Concrete mixing box or wheelbarrow
Mortar mixing hoe and trowel
Screwdriver with 1/8" wide blade
Set of allen wrenches
Needle nose pliers
Set of open end wrenches 1/4 to 3/4"
Rat tail file
Hand drill and drill bits
18" carpenter's level
10' measuring tape
50 ohm RF dummy load with BNC connector

4.4 Installation Supplies

3 to 5 90-pound sacks of redi-mix concrete
2 five-gallon containers of water
Silicone grease
Plastic electrical tape
Scraps of styrofoam or other cushioning materials

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Telex: 275945 SMBK UR

Checked By _____

Approved By _____ 1-12-87

SIERRA-MISCO, INC.
MODEL 5081 SELF-REPORTING WEATHER STATION
INSTRUCTION MANUAL, Document #A102857-1

This manual includes:

8 pages	Text
A100964	Calibration Curve, %RH vs 0-5v
A101096	Calibration Curve, -80 to 175 degrees F vs 0-5v
A101044	Voltage vs Binary Code Curve
A106309	Sensor Cable Diagram, Barometric Pressure
A107369	Sensor Cable Diagram, Wind Speed/Wind Direction
B107417	Six Parameter Weather Station PCB Assembly Diagram
C102303	Assembly Diagram
C107416	Six Parameter Weather Station PC Board Schematic
C107418	Six Parameter Weather Station Wire Diagram

Add to this manual:

Basic Gauge Installation Manual
Transmitter Manual
Solar Panel Manual
Sensor Manuals as required,
standard set consists of models 1522, 2042, and 5050P

1.0 INTRODUCTION

1.1 General Description

The 5081 Real Time Event Reporting Weather Station is a totally self-contained, packaged weather station used to automatically report weather data from remote sites to a central site. The station consists of an array of sensors, a transmitter, a solar panel, interconnecting cables, antenna and station housing. Sensors are supplied complete with cables and connectors. The main housing acts as the sensor support, antenna tower and weather proof housing for the transmitter.

1.2 Specifications

Equipment Supplied -

Transmitter:	Model 5050 Transmitter with 5050A0 Analog Option, 5050CP Connector Package and signal conditioning
Power Supply:	Model 5031 gel cell battery augmented with Model 5033 Solar Panel
Antenna:	5050ANT Omni antenna, height from ground: 18 feet
Dimensions:	Refer to Assembly Diagram (drawing #C102303)
Shipping Weight:	Between 85 and 110 pounds, depending on options

Standard Sensors -

Precipitation:	Model 5050P Tipping Bucket Height of orifice from ground, 13'8" Orifice 12" diameter
Humidity/Temperature:	Model 2046 with radiation shield Model 4550
Barometric Pressure:	Model 1522
Wind Speed:	Model 5050WS
Wind Direction:	Model 5050WD
Optional Sensors:	One digital, one analog, as specified

2.0 INSTALLATION

Refer to Basic Gauge Installation Manual

3.0 OPERATION

The 5081 standard weather station has two types of sensors, digital sensors and analog sensors; refer to the Six Parameter Weather Station Wire Diagram, drawing C107418. Digital sensors operate in the event mode. Analog sensors are all operated either in the timed mode or the event mode. For detailed operational information on the transmitter refer to the model 5050 manual.

3.1 Digital Sensors

The signals from the precipitation sensor and extra digital sensor, such as a 5050LL-FT float sensor, go directly from the

sensor interconnect PC board to the digital accumulators on the transmitter PC board. Each time an incremental change occurs the signal adds one to the accumulator and the transmitter transmits the sensor ID number with the new accumulator number.

3.2 Wind Sensors

The wind speed and wind direction signals are transmitted simultaneously; the sensors are designed to transmit on an event basis. The transmitter will send each kilometer (or mile) of wind run and the instantaneous wind direction as each kilometer is counted. Each turn of the cup anemometer produces a voltage pulse which is counted in a counter on the weather station board. When 1308 counts are recorded, the counter resets itself. When the counter resets itself, a count is sent to the transmitter board. One unit is added to the accumulator and simultaneously the transmitter board powers up the 5V to the wind direction sensor. The voltage from the wiper of the 1K wind direction potentiometer is fed through the weather station board to the transmitter board where it is read by the analog to digital converter. The transmitter then transmits the wind sensor ID number (which is the ID number set on the transmitter minus 3), an accumulator number and the wind direction in binary code. The accumulator for wind speed resets to 00 after it reaches 31. The computer calculates the wind speed based on the difference in time between the accumulator numbers. Refer to the Model 5050 manual for details of wind message transmission format. The computer algorithm requires several sequential wind transmissions in order to validate and file accurate wind speeds and wind directions. Transmissions initiated by the test button on the board will not give accurate readings in the computer. The only way to get accurate wind information is to have the anemometer and counting circuit go through the full counting sequence.

3.3 Standard Analog Sensors

Analog sensors, whether operated in the timed or event mode (see transmitter manual) operate as follows: the 12V switched voltage is switched on and routed to the weather station board or directly to the individual sensor signal conditioning board. There it is changed to the individual sensors required power up voltage or if the same routed directly to the sensor interconnection board via J14. As all sensors used with the transmitter power up very quickly (less than 5 milliseconds) the signal out of the sensor returns through the sensor cable almost simultaneously. The signal is sent to the weather station board via J14 conditioned to a 0-5V signal and sent via J3 to the logic board to be read by its A to D converter. In order to calibrate the analog sensors while connected to the 5050 transmitter, the power must be turned onto the sensor interface board. This can be easily done by depressing the reset or the test button on the logic board. It is best to use the reset button as it will not cause the transmitter to transmit every 14 seconds.

3.4 Optional Analog Sensor

If you did not order an optional analog sensor with your weather station, the optional analog sensor port will not be operational. If at a later date you order an analog sensor to operate with the 5081 weather station, check to see if the transmitter has the Weather Station Signal Conditioning PC Board installed. If not, one is required. If it has one already, the following must be done on the standard weather station board at J10 jumper, Pin 1 to Pin 24. This routes the signal from Pin A J21 (analog 4 Pin MS connector) on the top of the transmitter back through the weather station board to Pin 11 of J3 of the transmitter logic board. Refer to Model 5050 Transmitter manual. Next, on the Logic PC Board, to get that signal into Pin 11 of U7, you need to replace the jumper between Pin 11 and ground with C24 capacitor 1000 pf. Refer to Drawing C107416. In order to get VCS (12V) to the sensor to power it, you need to jumper at J10 of the weather station board Pin 13 or 14 to Pin 19 or 20. After making the change, connect the battery and 1) measure the VCS 12VDC at Pin C of the Analog connector. Do this while pressing the reset button; 2) measure the signal voltage from the sensor going to the logic board between TP, (ground) and Pin 11 of U7.

4.0 SENSORS

The 5081 standard sensor package includes: wind speed/wind direction, temperature/relative humidity, precipitation, barometric pressure, one spare analog (0-5VDC) and one spare SPDT digital input contact closure. Available optional sensors include: river level, soil moisture, evaporation, solar radiation and temperature. Specific information about the sensors can be found in the manuals supplied with each sensor.

4.1 Analog Sensor Calibration

All analog sensors are signal conditioned to give 0-5V out. This output is read in the analog section of the logic board by the analog to digital converter. The relationship between the DC analog voltage and the digital binary code is shown on Drawing A101044.

4.2 Humidity and Temperature Sensor Calibration, Model 2046

4.2.1 Temperature Sensor Calibration

To properly calibrate this sensor, it must be calibrated at both a high and low temperature. The only test which can be performed in the field is to compare the ambient temperature with a thermometer and see if the transmitted reading is within your desired accuracy requirements. We recommend a pre-calibrated spare sensor and PC board set be taken into the field as replacements and if the reading does not correspond to the desired degree of accuracy, the sensor and PC board may be swapped and the old set be recalibrated back at the central

station. One test that can performed in the field is check the voltage supplied to the 2046 sensor to be sure that it is 12.0 VDC +- 1.0 volt. Use an accurate digital voltmeter to do this. Check the voltage at pin E of the sensor connector on the transmitter using test point 1 for ground. An accurate thermometer should be used to calibrate the 2046 temperature sensor; check the voltage output of the 2046, refering to calibration curve #A101096. If it is not correct refer to the 2046 manual.

4.2.2 Humidity Sensor Calibration

A quick field check of the humidity sensor can be done using a sling psychrometer. Refer to the calibration curve #A100964. If the reading is off by more than the specified tolerance refer to the 2046 manual for correction procedure.

4.3 Wind Sensors

4.3.1 Wind Direction

The accuracy of the wind direction reading depends on correctly setting the zero or crossover point of the pot. The body of the vane is marked "N". When the pointer is lined up with "N" this is north. To accurately set the north point a digital voltmeter should be used. North should be true north, not magnetic. It is recommended a map be used and a landmark with a known bearing from the gauge be used to establish proper orientaion. A compass is not as accurate since metal objects and deviations between magnetic and true north can produce errors.

4.3.2 Wind Speed

The 5081 transmits a report for each kilometer (or mile) of wind run. This report consists of a sensor ID number. a wind run accumulator number and a wind direction value. The wind run is determined by a counting circuit on the Weather Station PC board which counts the rotations of the anemometer (two AC cycles per revolution). When the counting circuit reaches 1308, the equivalant of one kilometer of wind run, it produces a pulse which adds one to the wind speed accumulator on the Logic PC Board and the new accumulator number and the wind direction are transmitted as a single message. The Logic PC Board wind speed accumulator rolls over (returns to 00) at 31. The actual wind speed is computed at the receiving site based on the time interval between transmissions.

4.4 Barometric Pressure

Refer to the Model 1522 Barometric Pressure Sensor Manual enclosure. The output of the barometric pressure sensor is 0 to 5V. It is set at the factory for an 85 mb span and unless specified in the order it will be set for sea level elevation. The computer will decode the transmission to read from 950 to 1035 mb. The calibration curve supplied with the sensor should

be checked. If you are going to locate your weather station at a point other than sea level, an adjustment for the change in elevation must be made, otherwise the instrument's calibration will not be readable by the computer. Refer to the 1522 manual for more information.

4.5 Precipitation

Refer to the 5050P Manual.

5.0 MAINTENANCE

As long as the data coming to the central station is consistant and no troubles are detected, the weather station need only be visited once a year.

5.1 If a solar panel is not used, the battery should be replaced with a freshly charged battery once a year. The battery must be charged very carefully in order to be sure it is fully charged. Its charged capacity should be checked by discharging it. Refer to battery curves and battery section of 5031 manual. If a solar panel is used, the solar panel output should be checked and the solar panel cleaned. Refer to Model 5033 Manual.

5.2 The silica gel absorbant packet in the transmitter should be replaced with a new or freshly charged packet. The packet can be recharged by heating to 250 degrees F for sixteen hours.

5.3 Whenever going to a site, it is desirable to check all the cables and connectors as well as the forward and reverse power in order to be sure the antenna and antenna cable have no been damaged during the year. If a directional antenna is used at the site its bearings should be checked to be sure it is still correct.

5.4 The sensors should be serviced as outlined in their separate manuals.

5.5 The outer rain gauge collection funnel should be cleared of all debris. Ensure that the funnel nipple is clear by running a brush or large pipe cleaner through it. Also clean the drain screens.

6.0 TROUBLESHOOTING

6.1 General

6.1.1 If the station does not transmit correctly, first check all battery connections to ensure a solid connection. Check the transmitter set switches and be sure it been powered up correctly. Check the battery while the unit is attempting to transmit to be sure it has sufficient voltage to power the instrument and is securely in place; also check the battery

terminals to ensure that they are clean and provide solid contact with the battery.

6.1.2 Check the sensor cable connections both at the sensors and at the transmitter; cable shorts can cause lack of readings. If a connection is found to be loose, tighten it and check to see if the problem has been corrected.

6.2 Checking and Replacing Sensors

6.2.1 Wind Direction Sensor

The wind direction sensor can be checked and/or replaced without powering down the transmitter by disconnecting the sensor cable at the transmitter. First check the resistance of the potentiometer in the sensor by connecting an ohmmeter across pins D and E of the cable connector; it should read 1000 ohms (1K) regardless of the position of the wind vane. Be sure the nuts on the bottom of the sensor to not make contact with the sensor support pipe or incorrect analog values may result. Next connect the ohmmeter across pins C and D of the cable connector and observe the readings with relation to the direction of the vane; North equals 0 or 1000 ohms, East equals 250 ohms, South equals 500 ohms and West equals 750 ohms. Slowly rotate the vane until the reading suddenly changes from 1000 to 0 ohms: this is the north point, essentially the point at which the vane tip should be pointing north indicating a wind coming FROM the north. Check to see that the north point has been set correctly by comparing the direction of the vane with the north line scribed on the sensor casing and the meter reading. If it is off, rotate the sensor support post to correct. If the potentiometer needs to be replaced, leave cable disconnected from transmitter. Loosen but do not remove the set screws on the sensor arm which secure the wind direction sensor in place. Gently lift the sensor up a few inches giving access to the underside of the sensor casing. Remove the metal retaining ring and carefully separate bottom and top sections. Remove the vane from the top section by pulling up on it with a firm steady pressure. Remove the nut which holds the potentiometer in place. Make a note of which color wire goes to which terminal and then cut the three wires to the potentiometer as close to the terminals as possible and solder them to the replacement potentiometer. Refer to Sensor Cable Diagram, Wind Speed/Wind Direction, drawing #A107369. Reverse steps to reassemble and realign north point as described in this section.

6.2.2 Wind Speed Sensor

The wind speed sensor can be checked and/or replaced without powering down the transmitter by disconnecting the sensor cable at the transmitter. First check the output of the sensor by connecting an ohmmeter across pins A and B of the cable connector; spinning the anemometer by hand should produce an output of approximately half of a volt. Refer to section 3.2 for technical details of sensor output. If the sensor needs to be

replaced, leave cable disconnected from transmitter. Loosen but do not remove the set screws on the sensor arm which secure the wind speed sensor in place. Gently lift the sensor up a few inches giving access to the wires underneath. Cut the two wires at the covered splice and solder replacement sensor to the wires as follows: Red to Red, Brown to Black. Refer to Sensor Cable Diagram, Wind Speed/Wind Direction, drawing #A1C7369. Reverse steps to reassemble.

6.2.3 Barometric Pressure Sensor

Check the barometric pressure sensor as described in the 1522 manual. If the sensor needs to be replaced, first disconnect the cable at the transmitter and pull up on the sensor to remove from the mounting plate inside standpipe. If a replacement sensor is to be installed be sure to remove the mounting plate and hardware from the old sensor and attach to the new one.

6.2.4 Precipitation Sensor

Refer to 5050P Tipping Bucket Rain Gauge Manual

6.2.5 Humidity and Temperature Sensor

Check the sensor as outlined in the 2046 manual. If the sensor needs to be replaced, first remove access plate and disconnect the wires from the terminal block. Then loosen the U-bolt and gently slip sensor off end of sensor arm. Reverse steps to reassemble taking care to observe the correct wiring at the terminal block as described in the 2046 manual.

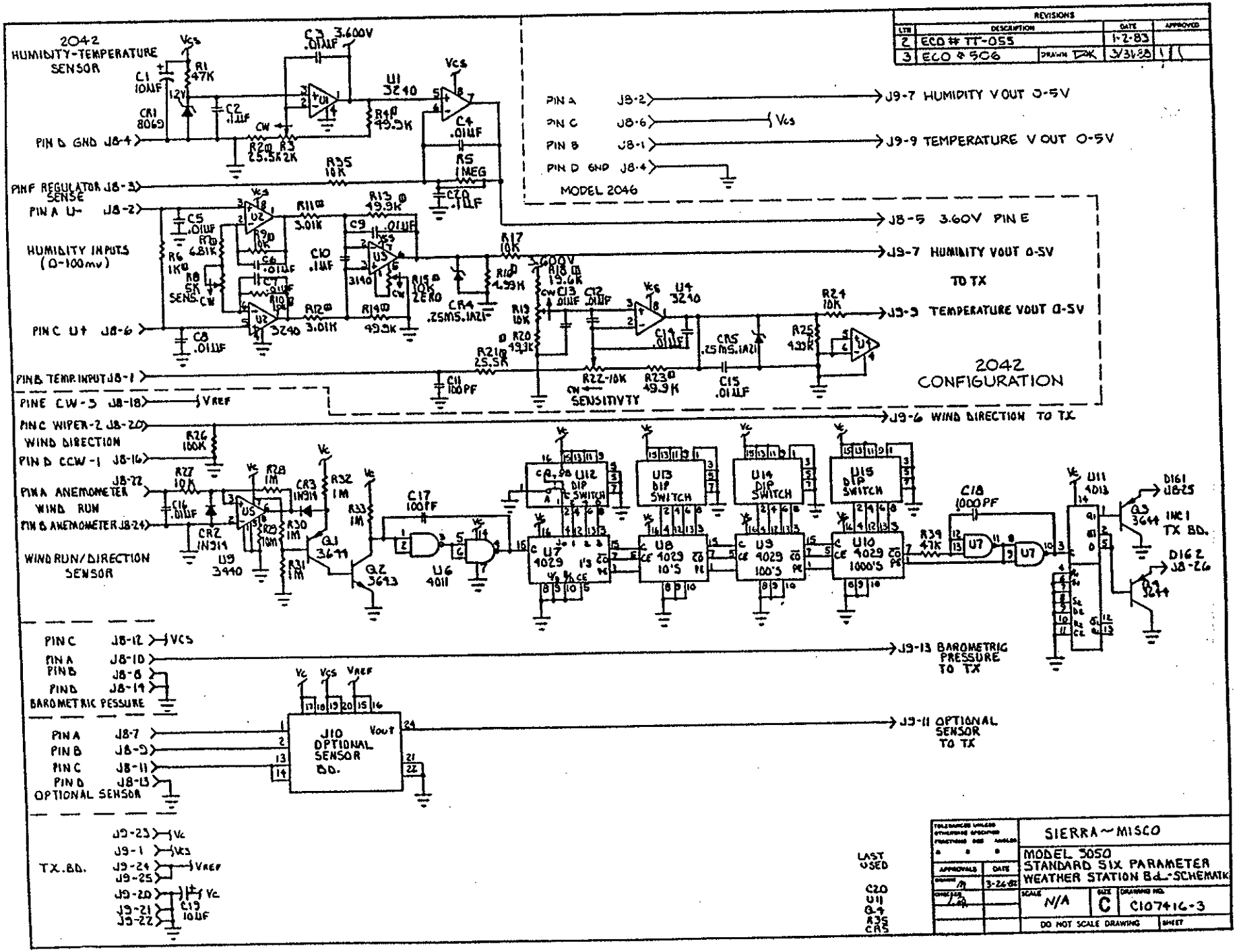
6.3 Return Proceedure

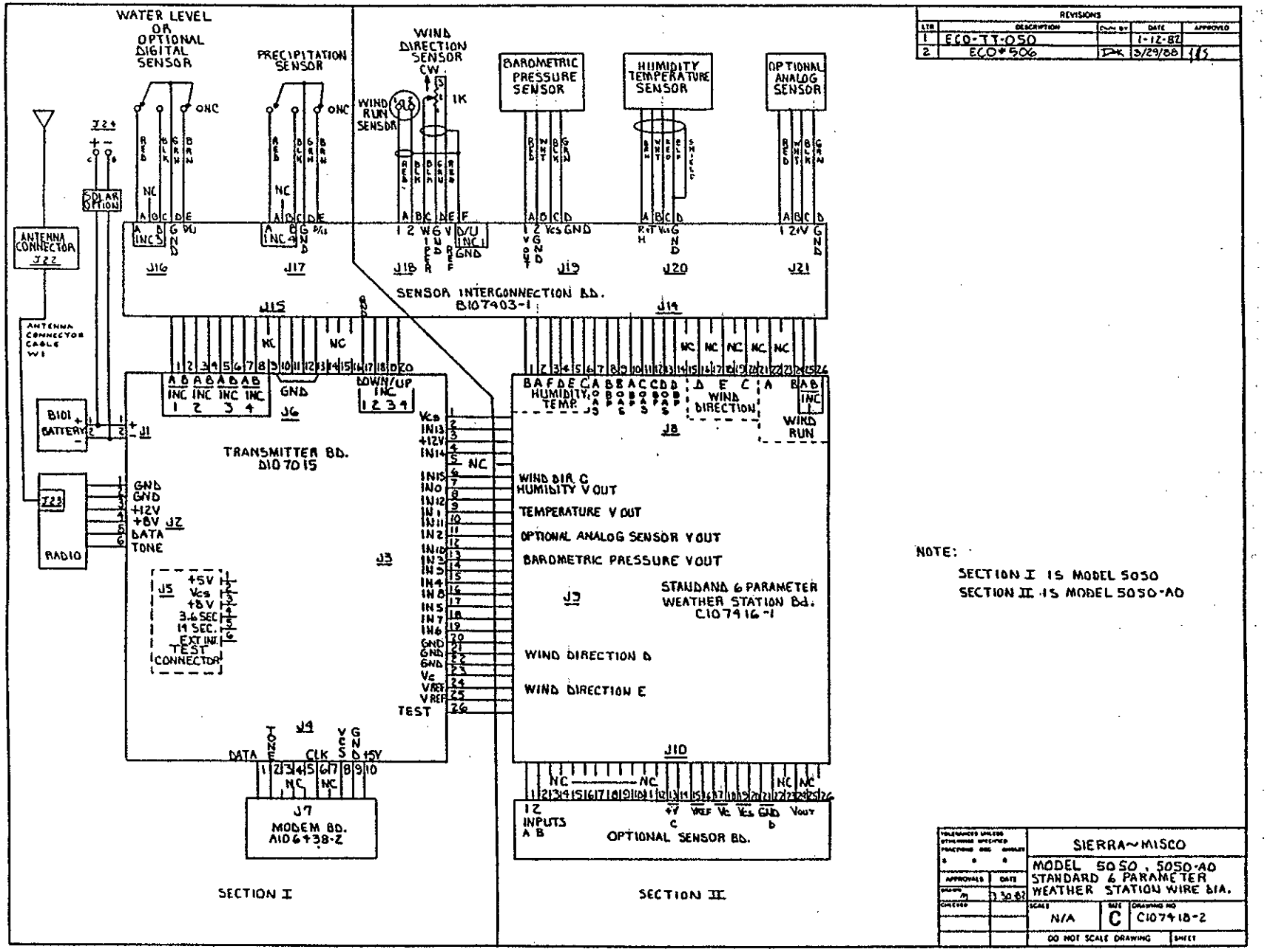
If it becomes necessary to return any componant of the station to the factory for any reason, call Sierra-Misco at (415) 843-1282 between 9:00 AM and 3:00 PM (Pacific Standard Time) and ask for a Return Authorization Number to be assigned to your instrument. Carefully pack the instrument so that it will not be damaged in shipment and write the Return Authorization Number on the box and on any paperwork included in the box with the instrument. It is helpful to also include a short description of the problem. If you are unable to reach us by telephone, please write a detailed description of the problem and under what conditions it failed, or other reason for return, and include it with the instrument.

SIERRA-MISCO, INC.
1825 Eastshore Highway
Berkeley, California 94710
Telephone: (415) 843-1282
Telex: 275945 SMBK UR

Checked By _____

Approved By JRS 3-88


REVISIONS
LTR DESCRIPTION DATE APPROVED
2 ECO # TT-055 1-2-83
3 ECO # 506 DRAWN TAK 3/31/83
2042 HUMIDITY-TEMPERATURE SENSOR
PIN A J8-2 → J9-7 HUMIDITY V OUT 0-5V
PIN C J8-6 → Vcs
PIN B J8-1 → J9-9 TEMPERATURE V OUT 0-5V
PIN D GND J8-4
MODEL 2046
PIN F REGULATOR SENSE J8-3
PIN A U- J8-2
PIN C U+ J8-6
HUMIDITY INPUTS (0-100mv)
PIN B TEMP INPUT J8-1
J8-5 3.60V PIN E
J9-7 HUMIDITY V OUT 0-5V
TO TX
J9-9 TEMPERATURE V OUT 0-5V
2042 CONFIGURATION
PIN E CW-3 J8-18 → VREF
PIN C WIPER-2 J8-20
WIND DIRECTION
PIN D CCW-1 J8-16
J9-6 WIND DIRECTION TO TX
PIN A ANEMOMETER J8-22
WIND RUN
PIN B ANEMOMETER J8-24
WIND RUN/DIRECTION SENSOR
PIN C J8-12 → VCS
PIN A J8-10
PIN B J8-8
PIN D J8-19
BAROMETRIC PESSURE
J9-13 BAROMETRIC PRESSURE TO TX
PIN A J8-7
PIN B J8-9
PIN C J8-11
PIN D J8-13
OPTIONAL SENSOR
J10 OPTIONAL SENSOR BD.
J9-11 OPTIONAL SENSOR TO TX
TX.BD.
J9-23 → Vc
J9-1 → Vcs
J9-24 J9-25 → VREF
J9-20 J9-21 J9-22 → Vc
C19 10UF
LAST USED
C20
U11
Q4
R35
CR5
SIERRA-MISCO
MODEL 5050
STANDARD SIX PARAMETER
WEATHER STATION Bd.-SCHEMATIC
SCALE N/A
SIZE C
DRAWING NO. C107416-3
DO NOT SCALE DRAWING
SHEET



REVISIONS				
LTR	DESCRIPTION	DWN BY	DATE	APPROVED
1	ECO-TT-050		1-12-82	
2	ECO#506	DK	3/29/88	

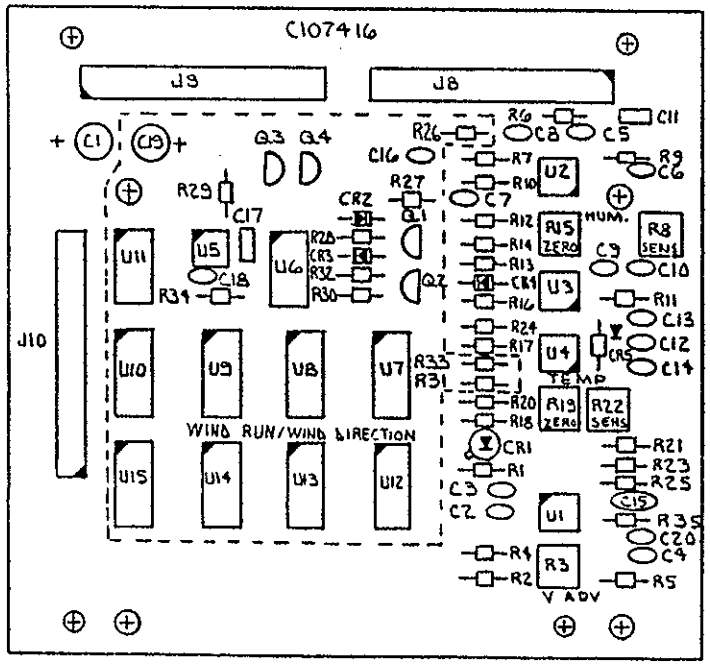
NOTE:

SECTION I IS MODEL 5050

SECTION II IS MODEL 5050-AO

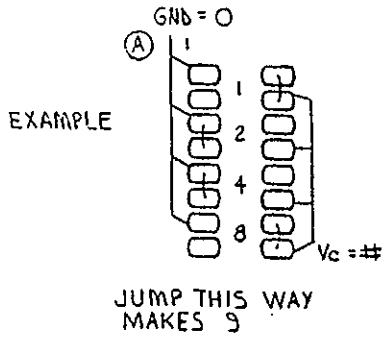
SIERRA~MISCO	
MODEL 5050, 5050-AO STANDARD 6 PARAMETER WEATHER STATION WIRE DIA.	
SCALE N/A	SIZE C
DRAWING NO C107418-2	
DO NOT SCALE DRAWING	SHEET

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
2	ECO # TT-055	1-2-83	
3	ECO - TS-126	5-24-85	



NOTES:

1. SCHEMATIC DIA DWG NUMBER C107416
2. J10 ONLY INSERTED WHEN OPTION SENSOR BD. IS USED
3. J8 & J9 ARE ALLWAYS USED
4. WIND RUN - U12 THRU U15 ARE OPTIONAL DIP SWITCHS, WHEN NOT USED JUMPERS CAN BE INSERTED SEE (A)
5. DELETE R5 AND C4
6. FOR TEMPERATURE PROBE AD590 USE OPTIONAL SENSOR INPUT AND CUT: J8-13 FROM GROUND, JUMP: J8-13 TO J8-7, JUMP J8-1 TO J8-9, WHEN USED WITH 4 DIGITAL 2 ANALOG SENSOR INTERCONNECTION PCB-B107457



APPROVALS	SIERRA ~ MISCO
DRAWN M	MODEL 5050 STANDARD SIX PARAMETER WEATHER STATION-ASSY DWG
3-26-82	SCALE 1:1 · SIZE B · B107417-3
	DO NOT SCALE DRAWING